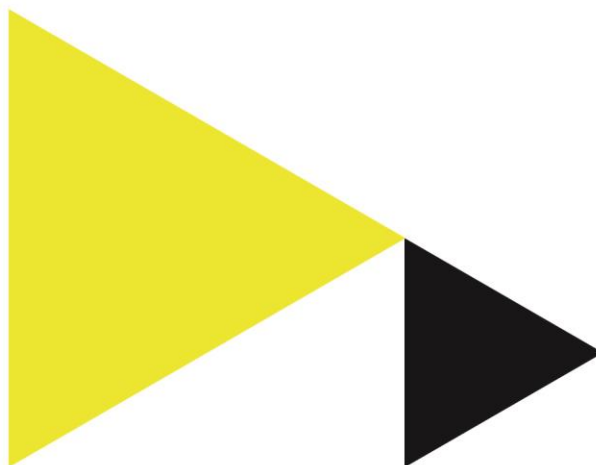


# Learning Python through coding music

Course Guide

AUAS Summer School  
2022



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Course Guide

## Lecturers

Krijn Hoogendorp & Tim Langstraat

## Department

AUAS Summer School

## Course dates

4 July 2022 – 15 July 2022

Version 1.0

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# Course overview

## Introduction

Python is one of the most used programming languages. It has a very large user base and there is a wide variety of python libraries available which make Python a useful language in many contexts. In this summer course, the programming tool Earsketch will be used to learn the basic Python programming concepts such as loops, functions and variables. While learning Python is the main objective, you will also be working on your own music and beats.

## Target audience

This course is suitable for any bachelor student interested in coding and music. No previous experience in programming or music is needed. There will also be lectures on musical concepts and on the underrepresentation of certain groups in STEM activities (Science, Technology, Engineering and Mathematics). The students will need a laptop with WiFi possibilities and a headphone. Internet access will be provided by AUAS.

## Course details

<b>Author(s)</b>	Krijn Hoogendorp & Tim Langstraat
<b>Module ID</b>	-
<b>Academic year</b>	2021-2022
<b>Course dates</b>	4 July 2022 – 15 July 2022
<b>ECTS</b>	2 ECTS
<b>Course level / entry requirements</b>	Bachelor students. No programming knowledge needed. No musical background needed.
<b>Study load</b>	60 hours
<b>Assessment</b>	Exercises, end product and essay
<b>Type of diploma</b>	Certificate
<b>Course website</b>	<a href="https://www.amsterdamuas.com">AUAS Summer course: Learning Python through coding music - AUAS (amsterdamuas.com)</a>

# Course contents

Python is one of the most used programming languages. It has a very large user base and there is a wide variety of python libraries available which make Python a useful language in many contexts. Examples of libraries are TensorFlow for Artificial Intelligence applications and OpenCV for image manipulation.

In 2012, two professors at Georgia Institute of Technology started the development of an educational programming environment to teach coding through music composing and remixing. They chose Python and JavaScript as the languages being used. The environment, EarSketch, combines a digital audio workstation (DAW) with a code editor and a sound browser. It contains music samples created by sound designers Richard Devine and Young Guru (Jay Z's sound engineer). The software toolset enables students to create music by manipulating loops, composing beats, and applying effects with Python code. In this summer course, EarSketch will be used to learn the basic Python programming concepts such as loops, functions and variables. While learning Python is the main objective, you will also be working on your own music and beats.

Programming is getting essential to a wide variety of academic disciplines and proficiency and understanding of computing is expected in an ever increasing amount of professions. Traditionally programming has been taught with assignments related to mathematics and statistics. However, many of the software developers make only limited use of their math skills. It is also very well possible to learn programming in other contexts such as music or design. EarSketch attempts to increase and broaden participation in computing by creating an engaging and culturally relevant learning experience using a personal meaningful approach. Music is considered a context which might engage diverse student populations in programming.

## Learning objectives

In this course the participants will learn the basic Python programming language concepts through the coding of sound and music. Learning to code through a music context is an innovative way to help students become digitally apt citizens. The creators of EarSketch, the tool used to teach programming in the summer course, aim to increase participation of currently under-represented groups in computing.

By the end of this course, you can:

- work with the elementary Python programming concepts (such as loops, datatypes, lists, randomness);
- use coding to create basic musical structures (such as tempo, pitch, effects);
- work with the EarSketch development environment and DAW; and
- have a well-grounded opinion on the underrepresentation of social groups in computing and the imbalance in society of computer use and programming.

## Learning activities

In week 1 the students will learn how to use basic Python concepts to create music. This will be done through structured exercises and lectures on the relation between coding concepts and musical aspects such as rhythm, melody and effects. In week 2, the students will apply the skills learned in week 1 to produce an original musical work through coding. They will be asked to analyze and evaluate their

experience with EarSketch in a paper and in a discussion.

## Lecturers

### Krijn Hoogendorp

Krijn Hoogendorp is teacher/researcher at the Cyber Security department of the Amsterdam University of Applied Sciences. His interests include Forensic Computing, programming drones and Artificial Intelligence. He has authored books on Android, Artificial Intelligence, and on the Raspberry Pi. In his previous careers he worked for over 15 years as infrastructure specialist, technical teamlead en IT project manager at IBM and ABN AMRO bank and as a humanitarian aid worker. Krijn Hoogendorp holds master degrees in Education, European Studies, and Asian Studies. He is a certified teacher Computer Science.

### Tim Langstraat

Tim Langstraat is teaching at the AUAS HBO-ICT programme since August 2021, helping students understand the fundamentals of IT and cybersecurity. In his classes, he emphasizes on combining seemingly unrelated fields can lead to productive creativity – something showcased in his own career path as well. Tim holds a master's degree in Marketing Management and has studied in The Netherlands and Singapore. He has extensive working experience related to data management. In his spare time he enjoys listening to a wide variety of music, such as classical music, post-rock, electropop, and many other genres. Tim lives in Amsterdam with his partner, daughter, and cat.

## Study programme

Week 1	
<b>Day 1</b>	09:00 – 10:00 Registration 10:00 – 11:00 Opening Summer school 11:30 – 12:30 General introduction course 12:30 – 16:30 Get started with EarSketch (chapters 1, 2 and 23 - Hour of Code with EarSketch)
<b>Day 2</b>	09:30 – 10:30 Presentation on variables and datatypes 10:45 – 12:30 Working on practical assignment 1A (Python syntax) 12:30 – 13:30 Lunch 13:30 – 14:15 Presentation on rhythm and beats 13:30 – 16:30 Working on practical assignment 1B (chapter 3)
<b>Day 3</b>	09:30 – 10:15 Presentation on loops and layers in music and programming 10:30 – 12:30 Working on practical assignment 1C (chapter 4) 12:30 – 13:30 Lunch 13:30 – 14:15 Presentation on effects 14:30 – 16:30 Working on practical assignment 1B (chapter 5)
<b>Day 4</b>	09:30 – 10:15 Presentation on conditionals 10:30 – 12:30 Working on practical assignment 1B (chapter 6)

	12:30 – 13:30 Lunch 13:30 – 14:15 Presentation on functions, datastructures and melody 14:30 – 16:30 Working on practical assignment 1C (chapter 7 and 8 )
<b>Day 5</b>	09:30 – 10:15 Presentation on lists and list operations 10:30 – 12:30 Working on practical assignment 1D (chapter 9) 12:30 – 13:30 Lunch 13:30 – 14:15 Presentation on musical effects 14:30 – 16:30 Working on practical assignment 1E (chapter 10)
<b>Week 2</b>	
<b>Day 1</b>	09:30 – 10:15 Discussion on EarSketch as a tool for change 10:30 – 12:30 Working on Essay 12:30 – 13:30 Lunch 13:30 – 16:30 Working on Essay
<b>Day 2</b>	09:30 – 10:30 Presentation on Music Composition 10:45 – 12:30 Working on final project 12:30 – 13:30 Lunch 13:30 – 16:30 Working on final project
<b>Day 3</b>	09:30 – 10:30 Presentation on sample use 10:45 – 12:30 Working on final project 12:30 – 13:30 Lunch 13:30 – 16:30 Working on final project
<b>Day 4</b>	09:30 – 10:30 Presentation on messaging in music 10:45 – 12:30 Working on final project 12:30 – 13:30 Lunch 13:30 – 16:30 Working on final project
<b>Day 5</b>	09:30 – 12:30 Discussion on the effectivity of using music as a context to learn how to code. 12:30 – 13:30 Lunch 13:30 – 15:45 Presentation of projects 16:00 Certificate ceremony 17:00 Farewell drink

# Assignments & assessment

Assignments / Tests	Weight (%)
Exercises with EarSketch and Python (individual)	30%
End product (individual or in duo's)	50%
Essay	20%
<b>Total</b>	<b>100%</b>

## Study materials and recommended further reading

### Obligatory materials

Account on EarSketch (<https://ears sketch.gatech.edu>)

### Obligatory readings

Freeman J., Magerko B., Edwards D., Mcklin T., Lee T., Moore R. (2019). "EarSketch: engaging broad populations in computing through music." In Communications of the ACM.

### Recommended reading material

Freeman J., Magerko B., Edwards D., Mcklin T., Lee T., Moore R. (2019). "EarSketch: engaging broad populations in computing through music," in Communications of the ACM.

McKlin T., Lee T., Wanzer D., Magerko B., Edwards D., Grossman S., Bryans E., Freeman J. (2019). "Accounting for Pedagogical Content Knowledge in a Theory of Change Analysis," in Proceedings of the 2019 ACM Conference on Innovation and Technology in Computer Science Education.

McKlin T., Lee T., Wanzer D., Magerko B., Edwards D., Grossman S., Bryans E., Freeman J. (2019). "Exploring the Correlation Between Teacher Pedagogical Content Knowledge and Content Knowledge in Computer Science Classrooms," in Proceedings of the 2019 ACM Conference on Innovation and Technology in Computer Science Education.

Wanzer D., McKlin T., Edwards D., Freeman J. and Magerko B. (2019). "Assessing the Attitudes Towards Computing Scale: A Survey Validation Study," in Proceedings of the 50th ACM Technical Symposium on Computer Science Education.

Siva, S., Im, T., Freeman, J., Magerko, B. (2018). "Using Music to Engage Students in an Introductory Undergraduate Programming Course for Non-Majors," in Proceedings of the 49th ACM Technical Symposium on Computer Science Education (SIGCSE).

McKlin, T., Magerko, B., Lee, T., Wanzer, D., Edwards, D., and Freeman, J. (2018). "Authenticity and Personal Creativity: How EarSketch Affects Student Persistence," in Proceedings of the 49th ACM Technical Symposium on Computer Science Education (SIGCSE).

Magerko, B., Freeman, J., McKlin, T., Reilly, M., Livingston, E., McCoid, S., Crews-Brown, A. (2016). "EarSketch: Thick Authenticity in a STEAM-based Approach for Underrepresented Populations in High School Computer Science Education," in ACM Transactions on Computing Education (accepted and in press).

Freeman, J., Magerko, B., Edwards, D., Miller, M., Moore, R., and Xambó, A. (2016). "Using EarSketch to Broaden Participation in Computing and Music," in Proceedings of Sound and Music Computing (SMC 2016), Hamburg, Germany.

Moore, R., Edwards, D., Freeman, J., Magerko, B., McKlin, T., and Xambó, A. (2016) "EarSketch: An Authentic, STEAM-based Approach to Computing Education," in Proceedings of the 2016 American Society for Engineering Education Annual Conference & Expo, New Orleans, Louisiana.

Helms, M., Moore, R., Edwards, D., and Freeman, J. (2016). "STEAM-Based Interventions: Why Student Engagement is Only Part of the Story," in IEEE Research on Equity and Sustained Participation in Engineering, Computing, and Technology (RESPECT 2016), Atlanta, Georgia. [Add text]

## Contact information

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Tim Langstraat: [t.langstraat@hva.nl](mailto:t.langstraat@hva.nl)